

prévaut. Ce sont le cas de la polyandrie, comme par exemple dans le genre *Turnix*, dont les femelles combattent pour la possession des mâles. Ici nous devons appliquer les remarques exposées plus haut aux femelles.

Je suppose cependant avec Mr. Wallace, que dans plusieurs cas les couleurs ternes des femelles doivent être expliquées par le besoin de les protéger contre les attaques des ennemis ; mais seulement il ne faut pas regarder comme leurs ennemis les oiseaux de proie et les quadrupèdes, mais aussi les mâles célibataires de la même espèce, et ce sont peut-être les ennemis les plus redoutables.

Dans les cas où le dimorphisme sexuel est faiblement développé et ne peut être expliqué par la seule action de la sélection naturelle, nous devons recourir à la loi de corrélation de croissance, qui veut que certains changements dans la constitution de l'oiseau peut amener les changements dans différentes parties de son corps. Nous avons répété déjà plusieurs fois, que le rôle des femelles chez les oiseaux est beaucoup plus difficile que celui des mâles, et que dans plusieurs cas cette circonstance peut retarder son développement complet. On peut regarder la femelle dans ses formes extérieures comme un mâle non développé. Si donc nous prenons une espèce dont la femelle possède une riche coloration du mâle, mais aux teintes un peu plus ternes, comme par exemple dans le genre *Pharomacrus* (un Trogonidé), nous pouvons supposer que son développement est retardé (ou plutôt paralysé) par les difficultés surgis pendant l'époque de reproduction, c'est à dire par la présence d'ovaire, qui exige une nutrition plus grande que les glandes mâles. Cette supposition se confirme par le fait, que plusieurs femelles vieilles et malades, selon Darwin (et probablement qui ont perdu la fécondité), prennent les caractères mâles, puisque leur développement paralysé par les besoins maternelles atteint son plus haut degré depuis que la cause principale est supprimée.

2. On Hypertrophy, and its Value in Evolution. By JOHN BLAND SUTTON, F.R.C.S., Lecturer on Comparative Anatomy, Middlesex Hospital Medical College.

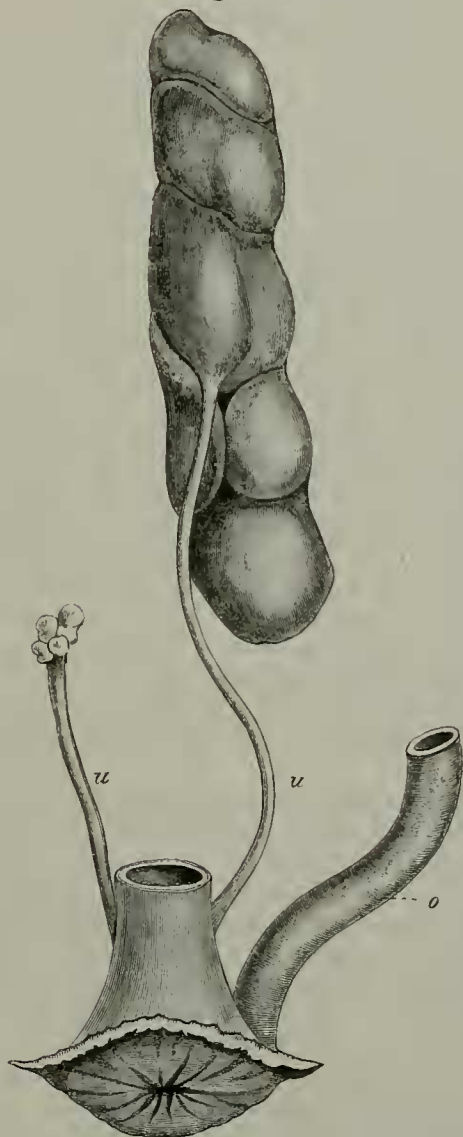
[Received March 23, 1885.]

Every known vertebrate normally possesses two kidneys, a right and a left one. In the case of the Fowl, the left kidney of which is represented in the drawing exhibited (fig. 1, p. 433), the right kidney had, from some cause or other, entirely disappeared, nothing but the ureter remaining to inform us of the previous existence of the associated kidney.

Such a case as this is by no means rare ; it has been repeatedly observed in man. I have myself observed it in five instances in the human subject, also in sheep, oxen, horses, and twice in birds. It is not my intention to enter into details as to the cause of the disappearance of this kidney ; it has been satisfactorily explained

long ago ; the important fact for my purpose is—that in this, as in similar cases of single kidney, the size and weight of the persistent organ far exceeds the normal, and in the majority of instances is

Fig. 1.



The cloaca and left kidney of a Fowl. The right one had disappeared, leaving merely the ureter *u*, with a small collection of tissue at its summit to testify that a right kidney had existed ; *o*, the oviduct. The persistent kidney is twice the natural size.

double the usual size. The kidney, in consequence of the loss of its fellow, has had to perform twice the amount of work usually required of it, and has doubled its bulk as a result of this increased

functional activity. The process by which this very desirable result has been attained is distinguished by the convenient term *hypertrophy*. Having illustrated what I understand by that term, let me now define it as "the enlargement of an organ beyond its usual limits as the result of increased function, or of some unusual condition of the corresponding or correlated organ."

The majority of instances of hypertrophy, usually recognized as such, are the result of disease. In the example just considered, the enlargement of the persistent kidney is the direct outcome of atrophy of its fellow; but if a careful inquiry be instituted, many conditions, which at first sight appear to be the result of perpetuated hypertrophy, in consequence of atrophy of neighbouring structures, will really admit another interpretation, viz. that the hypertrophy is in great measure responsible for the atrophy of those structures, and bears a definite relation to it.

No better example offers itself whereby my meaning may be elucidated than the middle metacarpal of the Horse.

The metacarpus of the Horse is composed of a greatly hypertrophied third metacarpal bone, whilst applied to the posterior lateral edges of this large bone may be seen two rudimentary metacarpals. Each of these bones represents a slender pyramid with its base upwards and the apex pointing directly downwards. Of the two bones the internal is thicker than the external, and often the longer of the two. The large bone represents the middle or third metacarpal, whilst its two slender companions correspond to the second and fourth metacarpals of the typical mammalian manus.

Thanks to the labours of Rüttimeyer and Marsh, we are now in possession of the palæontological history of the ancestors of our modern Horse. The facts on this point, so far as regards the manus, have been admirably summed up by Wiedersheim¹ as follows:—

The oldest known stem form of the Horse is *Eohippus*, which has been found in the Lower Eocene of North America. It possessed four well-developed fingers and the rudiment of a fifth, the thumb. Next we find that the thumb has completely disappeared in *Orohippus* and *Epihippus*, the four remaining fingers persisting. These animals were about the size of a Fox, whilst in the Upper Eocene *Mesohippus* had attained the size of a Sheep. Here three fingers only were well formed; a fourth merely existed as a rudiment, which in the next form, *Miohippus*, has become yet smaller. In the Pliocene representative, *Protohippus*, the last remnant of a fourth finger disappears and three only persist. This animal corresponds to the European *Hipparion*, and was of the size of an Ass. Another Pliocene form, *Pliohippus*, had the second and fourth fingers extremely rudimentary, the development of the third being alone significant. Lastly, we come to the modern Horse, with its peculiarly specialized manus.

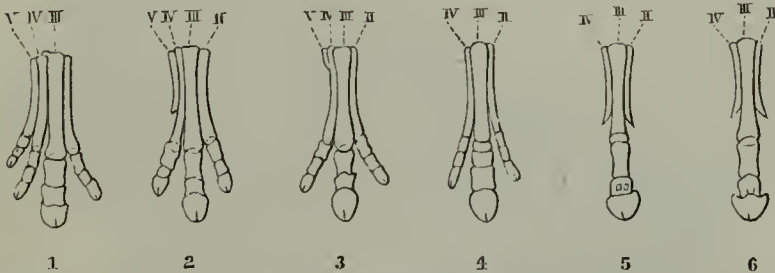
The accompanying figures are intended to afford a graphic representation of the preceding facts (fig. 2, p. 435).

¹ Vergl. Anatomie, vol. i. p. 198.

With such an array of evidence no one would venture to deny that the slender fourth and second metacarpals are rudimentary structures in the true sense and meaning of that term. These bones are often a nuisance to the animal, as they are exceedingly liable to inflame and produce lameness; the disease is known to veterinarians as splent-bone, and often ends in osseous ankylosis between them and the main metacarpal, a condition of things detrimental to the Horse for working purposes.

The history of this foot has been given, for it serves to illustrate a principle—hypertrophy of one structure leading to the atrophy of another; for in this case it seems the most probable view, that gradual increase in the size and functional importance of the third metacarpal bone has led to the abortion of the remaining bones, its original companions, by causing a diversion of the nutrient stream to its own advantage, but to the detriment of the lateral metacarpals.

Fig. 2.



A series of figures to show the ancestry of the manus of the modern Horse.
 1. *Orohippus* (Eocene). 2. *Meshippus* (Upper Eocene). 3. *Miohippus* (Miocene). 4. *Protohippus* (Upper Pliocene). 5. *Pliohippus*.
 6. *Equus* (after Wiedersheim).

In no structure is this principle so admirably illustrated or so easily studied as in the teeth of mammals. Take, for example, the curiously modified teeth of the Walrus; we shall find the enlarged and formidable incisors have for their companions some tiny functionless teeth of no use whatever to the animal: as a rule they quickly fall; even when they persist, there are scarcely any sockets provided for their reception. In this case it can hardly be denied that hypertrophy of the canines has led to atrophy of the remaining teeth.

The Felidæ supply us with similar examples. The large size to which the canines attain in this group leads to atrophy of the teeth immediately adjacent to them. This process seems, so far as the Felidæ are concerned, to have reached its culminating point in the extinct *Machærodus*, or Sabre-toothed Tiger, in which the canines have attained considerable dimensions, whilst some of the premolars in the upper and lower jaws have disappeared.

Let us now consider some other examples of hypertrophied teeth somewhat different from the last. The extraordinary canines of the male *Babirusa* have afforded plenty of scope to those imaginative

minds, who never come across anything out of the common but they must rack their brains to find out some useful purpose for which they think the abnormal organ may be utilized, never considering for one moment the absurdity of the explanation.

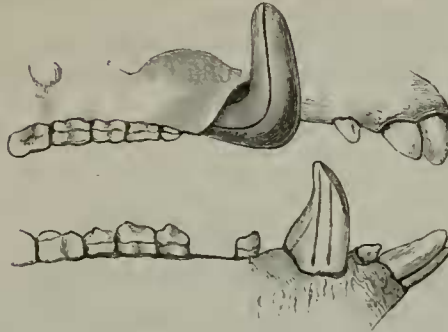
As is well known these teeth, like those of Rodents, grow from persistent pulps: if from any cause their growth is unopposed, as by want of antagonism between any two teeth, they grow to extraordinary length. In the case of the *Babirusa* it may readily be conceived that, from some cause or other, the upper and lower canines failed to come into apposition either by malformation or in a manner presently to be explained, and as a consequence grew enormously; the abnormality frequently recurring, the peculiarity became transmitted to the offspring, eventually becoming perpetuated to such a degree as to become a common feature in the anatomy of the males of this particular species.

Considered by itself, this isolated example perhaps does not carry much weight, but the condition may be approached insidiously from other specimens of the Suidæ. The first stage may be observed in the Wild Boar (of which the dentition is represented in fig. 3, p. 437), where the form and direction of the canines are peculiar. The lower canine is slender when compared with the upper, is of some length, and plays against the front surface of the upper one, becoming pointed in consequence. The upper canine passes at first horizontally outwards with an inclination forwards. After clearing the outer lip, its apex becomes directed upwards and inwards, describing in its course a semicircle. A similar condition is seen in the Wart-hog, *Phacochoerus alicani*; but the second stage is presented by *Phacochoerus æthiopicus*, in which the canine attains considerable proportions, as may be seen on reference to fig. 4 (p. 437).

In the third step we are confronted with *Babirusa*, whose excessive canines I maintain are inherited pathological peculiarities resulting from want of apposition, probably brought about in the first instance as a result of malformation (see fig. 5, p. 437).

It may, with reason, be asked, can an example be adduced of undoubted transmission of a pathological condition to the offspring so as to taint an entire community? An example offers itself in the so-called Tailless Trout of Islay. A careful and detailed account of this malformation is given by Prof. Traquair in the 'Journal of Anatomy,' vol. vi. p. 411. From this account it appears that the common Trout, *Salmo fario*, Linn., is frequently the subject of malformations, of which sigmoid distortions of the vertebral column and deficient development of the snout and jaws is the most common. In the present case, however, it is the caudal fin which is affected of all the Trout inhabiting a certain small lake. The most salient peculiarity of these Lochnamaorachan Trout is that the rays of the caudal fin are abnormally shortened, coarse at the extremities, and deficient as to the amount of dichotomization and number of the transverse joints; besides which they also show a tendency to coalesce at their terminations. By the convergence downwards of the upper long rays and upwards of the lower ones, the fin assumes

Fig. 3.



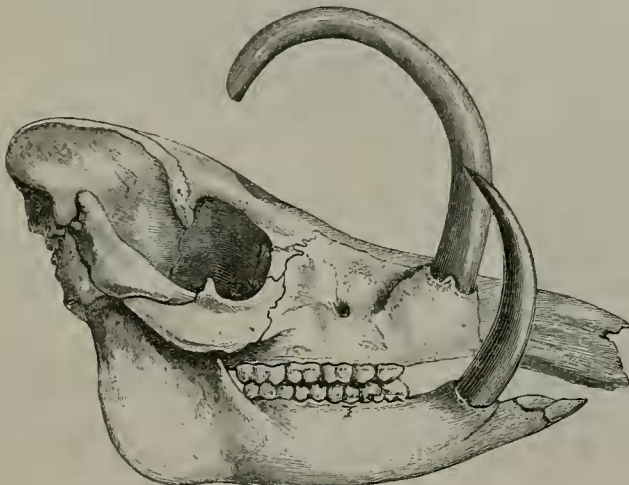
The dental series of a Wild Boar, showing the singular curve of the upper canine.

Fig. 4.



Head of Wart-Hog, *Phacochoerus aethiopicus*, ♂, showing a greater degree of curvature of the upper canine than that presented by the Wild Boar's tusk.

Fig. 5.

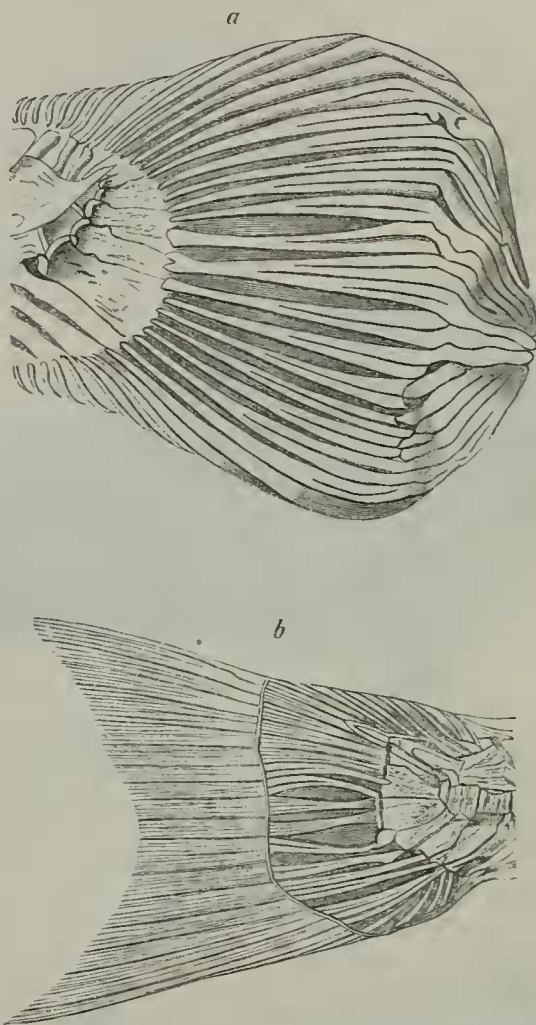


Skull of *Babirusa*, showing the most exaggerated stage of curved canines.
 PROC. ZOOL. SOC.—1885, No. XXIX.

a rounded form instead of presenting the usual broad fan-shaped aspect. The abnormal condition of the extremities of the rays may affect other fins besides the caudal (fig. 6).

The lake in question is about 1000 feet above the level of the sea.

Fig. 6.



The hard parts of the caudal extremity of the Trout. The upper figure (*a*) shows the abnormal condition of the extremities of the rays in the so-called tailless Trout of Islay (Lochnamoraehan Trout), after Traquair. The lower figure (*b*) shows the normal condition ; it is inserted for comparison.

It is about an acre in extent, and so shallow that a man can wade through it : the bottom is of quartz rock. Several other lochs near contain Trout, but none are "tailless." So constant is this abnormality in Trout taken from the lake in question that one keen

fisher, with thirty years' experience of this loch, has never taken any but docked ones.

It seems to me that these fish clearly inherit their deformity, and that it is a perpetuated pathological condition.

Returning to teeth, there can be little doubt that a similar process has been at work modifying the singularly aberrant tusks of the Narwhal, *Monodon monoceros*. Its huge size, the curious spiral twist, undoubtedly correlated with the peculiar unsymmetrical condition of the facial portion of the skull found in this Whale as well as among other members of the *Physeteridæ*, tend to support the notion of a pathological cause underlying these monstrosities.

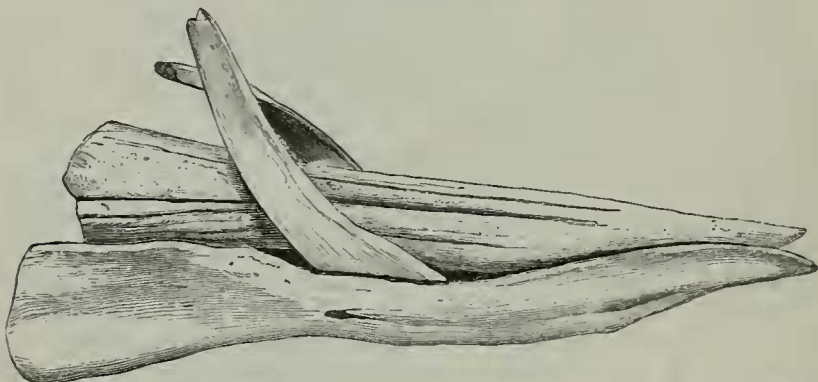
In this singular creature the adult male usually possesses a tooth growing from the left maxillary bone, in close relation with the maxillo-premaxillary suture and therefore regarded as a canine, which often attains a length of eight, nine, or even ten feet, with a basal diameter of four inches. The corresponding tooth of the opposite side usually undergoes development up to a certain point, and attains a size of six inches, but the pulp-chamber usually undergoes calcification before it has had time to make its way out of the alveolus, so that it remains concealed throughout the lifetime of the animal. Occasionally, however, this right tusk undergoes development, and equals in size the left one. Mr. J. W. Clark communicated to this Society in 1871 the results of an inquiry into the matter of double-tusked Narwhals, and has given in that very interesting paper details of no less than eleven bidental skulls of this Whale in different European Museums¹. This seems to afford evidence that normally the Narwhal should possess two teeth, but that from some cause or other the right one often remains suppressed in the alveolus; and there is the significant fact, pointed out by Mr. Clark, that whenever a solitary tooth is present it is the left one, the right never being developed alone. The spiral twist in connection with these tusks always winds round them from right to left; if two tusks be developed, the twist of the spiral is in the same direction in both, as regards the skull right to left, whereas they appear unsymmetrical in respect to one another. There can be little doubt that this curious twist in the tusks is the effect of the same cause, whatever it may be, that produces the remarkable distortion in the facial portion of the skull of these whales. Prof. Flower has described, in the *Trans. Odont. Soc.* 1879-80, some curious Elephants' tusks contained in the Museum of the College of Surgeons. These tusks are spirally twisted, the twist possessing in some instances two or more turns: a deep groove extends from base to apex. In this instance it is clear that the malformation resulted from injury to the growing pulp when the tooth was in embryo. There is no just reason why the same line of argument should not be applied to the Narwhal tooth. The tusk has yet other interest for the pathologist. Professor Turner was fortunate enough to detect in the skull of a foetal Narwhal two rudimentary teeth, all traces of which are lost in

¹ See P. Z. S. 1871, p. 42.

the adult, thus clearly showing that this animal originally possessed at least four teeth. After carefully reviewing these facts the conclusion forces itself upon me, that the modified dentition of this most singular animal has been attained by hypertrophy of its canine, leading to atrophy of its less used companions; but the original cause of the enlargement is as little known to us as is the cause of the asymmetry of its skull. There is probably no parallel to this in the animal kingdom—extreme hypertrophy, excessive atrophy, arrested growth, and malformation, exhibited in the dental armature of a single animal.

Among remarkable teeth must be included those of *Mesoplodon layardi*. The illustration (fig. 7) represents the anterior part of the rostrum and lower jaw with the teeth of the extraordinary specimen of this Whale brought home by the 'Challenger' Expedition. The

Fig. 7.



The rostrum of a Whale, *Mesoplodon layardi*, showing the singularly elongated and curved mandibular teeth. From the specimen obtained during the voyage of H.M.S. 'Challenger.' Figure taken from a cast in the Museum of the Royal College of Surgeons.

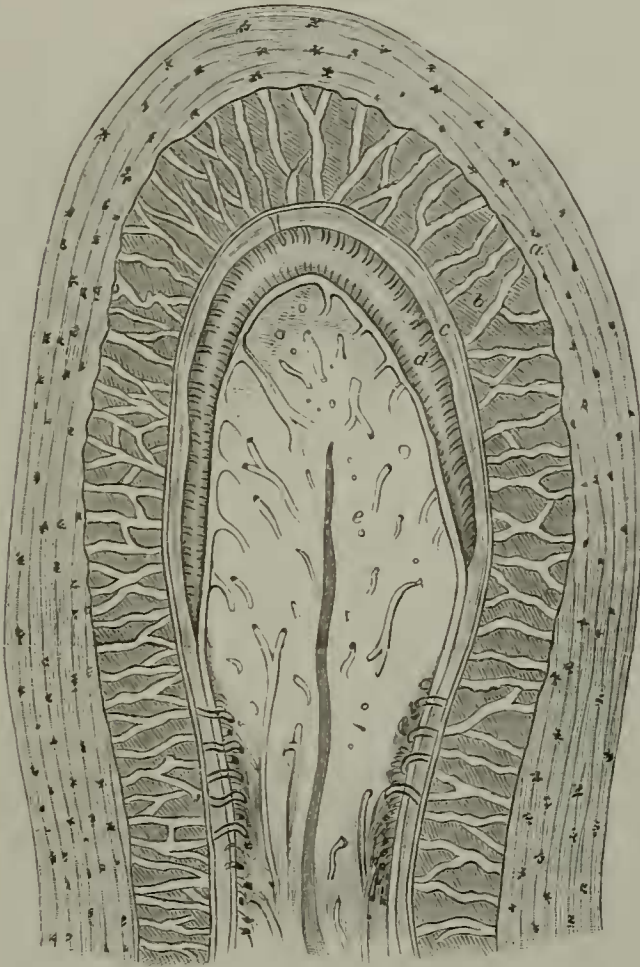
drawing was taken from a model of the specimen in the Museum of the Royal College of Surgeons, London. The specimen is thus described by Prof. Turner in his 'Report on the Bones of the Cetacea':—

"When I received from Mr. Moseley the lower jaw of the adult *Mesoplodon layardi*, only the left tooth was in its socket; the right had previously been extracted. The socket was situated at the junction of the symphysis with the body of the lower jaw, but more of the tooth was implanted in the body than in the symphysis. The length of the extracted tooth was 14 inches, $6\frac{1}{2}$ inches of which had been included in the alveolus, or surrounded by the gums. The breadth of the tooth where it emerged from the alveolus was $3\frac{1}{2}$ inches. Each tooth consisted of a denticle proper and a strap-shaped shaft. The shaft was laterally compressed, and as it emerged from the socket it curved obliquely backwards, upwards, and inwards, so that its inner concave surface had been in relation with the sides and dorsum of the beak. As the summit of each tooth passed to the opposite side of the middle line, the two teeth crossed each other on

the dorsum of the beak; and from the smooth appearance of the anterior border and inner surface of each shaft, it is evident that they must have rubbed against each other, or against the beak during the movements of the lower jaw in the act of opening the mouth."

Besides this specimen, Prof. Turner also received the skull and

Fig. 8.



A magnified vertical transverse section through the summit of the shaft of the tooth of the adult *Mesoplodon layardii*. The tooth is made up of the following tissues, from above downwards: *a*, cement; *b*, vaso-dentine; *c*, a layer of more opaque modified vaso-dentine; *d*, dentine; *e*, modified vaso-dentine of the centre of shaft. (After Turner.)

parts of the skeleton of an immature *Mesoplodon layardii*, which enabled him to determine the nature of the various parts of this strange tooth. Each tooth in this immature specimen was two inches from

before backwards, and not quite an inch long, and consisted of a small triangular denticle which represented the crown of the tooth, and of a larger part, which for descriptive purposes may be called the fang. The free surface of the denticle was invested with white enamel; subjacent to the enamel there was a well-defined mass of dentine which constituted the mass of the denticle. The exterior of the fang was coated with a thin layer of cementum, beneath which there was a thin layer of substance consisting of a granular matrix traversed by numerous canals, which were for the most part arranged perpendicularly to the surface of the fang, so as to extend from the dentine to the cementum. The pulp-cavity was lined throughout the greater part of its extent by a well-defined layer of this substance. The canals visible in this substance probably contained blood-vessels; in size they approximated to Haversian canals. This substance in all probability is vaso-dentine.

Turning, now, to the structural details of an adult specimen of these aberrant teeth, as seen in section (see fig. 8, p. 441), it will become evident, as Prof. Turner has explained, that the peculiar form of this tooth is due to changes in the fang, resulting from an enormous overgrowth of cementum and modified vaso-dentine, the former being produced from the alveolo-dental periosteum, the latter from the pulp.

My reasons for regarding this singular tooth as a pathological peculiarity are these:—

1st. The elongated portion of the tooth really consists of the fang, and in many animals, even where the teeth do not grow from persistent pulps, there is a great tendency when the crowns are unopposed for the fangs to elongate (hypertrophy). This condition is often very conspicuous in old horses.

2nd. The nutritive conditions of the tooth are exceedingly advantageous for its hypertrophy: not only is it well supplied from the pulp, but its layers of vaso-dentine place it in suitable relation with the alveolo-dental periosteum.

3rd. Judging from the condition of the crown of the tooth, even in adult Whales, it can be subjected to very little friction. Hence the structure, mode of nutrition, and lack of opposition, place this tooth in a very favourable condition to hypertrophy.

Before dismissing teeth, it will be well to point out how simple a matter it is to show that hypertrophy, especially if it be excessive, must almost of necessity lead to dwarfing of the structures more or less associated with it; this is particularly well illustrated in the case of the teeth. In man any tooth differs in size but little from those immediately adjacent; but if, as in the case of rodents, the incisors increase in size, out of all proportion to the neighbouring teeth, their augmentation in volume will lead to a "diversion of the nutrient stream" in their favour, but certainly to the detriment of the teeth immediately succeeding them in the dental series; and, as a matter of fact, these victimized teeth become so deprived of the essential element-blood, that they remain of stunted size, or have, in some cases, entirely disappeared. It must also be borne in mind that as the incisors increased in size, the effective employment

of the succeeding teeth (canines and premolars in rodents) became reduced to a minimum, so that diminished usage would also tend to lower the vascular supply: thus the two factors, diminished function and diversion of nutrient fluid, have brought about extreme atrophy and, in many cases, total disappearance of teeth.

Numberless other instances might be quoted, indeed they must readily suggest themselves to any mind that carefully meditates on the matter. The cases of *Mesoplodon* and *Monodon* seem to me to be very extreme examples of this remarkable process.

I propose now to consider some examples of hypertrophy as they affect the reproductive organs; and shall adduce evidence to show that this process is one of the probable causes of division into sexes. Many anatomists are of opinion that hermaphroditism is the primitive condition of the sexual organs.

Hermaphrodites are found in every group of the animal kingdom, but, except in some of the lowest forms (such as *Ctenophora* and *Chrysaora*) among the Cœlenterata, self-fertilization appears to be wholly exceptional, and in those forms in which it occurs the entire process is of very simple character. The rule in hermaphrodites appears to be this:—The male organs in one animal are used to impregnate the female organs of another, or *vice versâ*. Even in the Cestoda, where there are arrangements favourable to self-impregnation, we have no positive evidence that it takes place.

From this arrangement it would easily come to pass that if one animal used the male portions of its reproductive organs more freely than the female parts, they would, as a result of increased function, hypertrophy.

In the first portion of this paper I emphasized the fact that any marked degree of hypertrophy in one organ nearly always leads to dwarfing of the correlated organ or sets of organs; hence in the example considered, the female portions of the hermaphrodite organs remain dwarfed or *in statu quo*. This peculiarity would in the natural course of events be transmitted to the offspring, until at last the differentiation attains such a high degree, that unless hypertrophy of one set of organs occurs in each individual, propagation is impeded. Evidence on this point is afforded by the developmental history (ontogeny) of any mammal. Whilst the two sets of reproductive organs, male and female, up to a certain point maintain the same degree of growth, it is impossible to determine the sex of the embryo. As soon as one set begin to enlarge at a greater rate than the other, the sex becomes pronounced. The remaining organs may eventually disappear or merely exist in such a rudimentary condition as to be discerned only by the most diligent search.

Indeed this process has been observed to occur in a very complete manner in a single group, the Myzostomida. Dr. L. von Graff, in his "Report on the Myzostomida" collected during the voyage of the 'Challenger,' has noted the following interesting facts. Some species (*Myzostoma tenuispinum*, *M. willemoesii*, *M. inflator*, and *M. murrayi*) are originally descended from androgynous forms in which the organs of one sex have become gradually aborted; for in *Myzo-*

stoma cysticolum the female has rudiments of testes, but no male generative aperture.

In those forms in which the individuals inhabiting one cyst are not different in appearance, the sexual organs have a different structure; each individual is here androgynous, but differs from the free living androgynous species in that the testis is developed only on one side of the body, and there is but one generative aperture. In *Myzostoma pentacrinus*, however, there are small remnants of the other testis, but no second male aperture. The testis also, as in the dioecious forms, is a small compact gland. Since the testes of the dwarf males are fully developed on both sides, we must not regard the hermaphrodite species *M. pentacrini* and *M. deformatum* as transitional between the typical hermaphrodite forms and those that are dioecious, but the latter must be derived independently from living forms.

In *M. cysticolum* the male and female are found associated in a common cyst, and increasing in size with the growth of the cyst perforate the arm-joints of their host together. The growth of the cyst is, of course, caused by the presence of the parasite; the female deposits her eggs within the cyst, and the young embryos, after they have abandoned the cyst and lost their ciliated coat, associate together in pairs, and bore their way through the arm-joints. In both the sexual development begins with the appearance of testes; but in the female the testes disappear entirely, or leave but a minute rudiment, when the ovaries make their appearance in addition¹.

Among the most striking examples of the peculiar value of hypertrophy in this direction must be mentioned the curious malformed generative organs which occur in the cattle known as "Free-martins." Hunter was one of the first to carefully investigate the condition of the reproductive organs in these cases; and the valuable dissections he made, now in the Hunterian Museum, are striking monuments of his inquisitiveness in this matter.

Stock-breeders hold the opinion that when a cow produces twins, one a male and the other a female, the latter is unproductive (imperfect). This is very frequently true, but by no means always so. An imperfect calf under these conditions is known as a Free-martin or Martin-heifer. Careful comparison of the detailed descriptions of the dissections of these malformations, and similar cases in Sheep and Goats which have come under my observation, show most conclusively that in these cases we have to deal, not with any one malformation common to all examples of Free-martins, but rather with instances in which both sets of organs have attempted to attain a functional condition, with the result that both have failed to reach it. In some of these cases the Wolffian ducts have advanced many stages towards making a fairly complete set of efferent ducts for the testicles, and the calf approaches somewhat to a bull-calf. In other instances the Müllerian ducts have made greatest progress, and a

¹ I am indebted to Mr. F. Beddard for drawing my attention to these interesting observations of Dr. von Graff.

diminutive uterus can be made out, and in this case the calf most resembles a cow-calf. Between these two extremes there is every gradation and variation. Similar cases occur in fishes, reptiles, amphibians, birds, &c. I have seen many cases, and numberless instances have been recorded out of curiosity.

These cases show most conclusively how impossible it is for both sets of reproductive organs to attain a functional condition in the same individual. Hypertrophy of one set must arise and establish pre-eminence over the other.

The facts on which the argument rests, that hypertrophy is one of the causes of division of sexes, may be summarized as follows:—

(1) In the lowest forms of animal life, hermaphroditism is the prevailing condition.

(2) Cross-fertilization in hermaphrodites is the rule, and may, as in some of the *Myzostomata*, lead to a division into sexes within the limits of a single group.

(3) Sporadic cases of hermaphroditism are far more common in the lowest forms of life.

(4) If in mammals both sets of organs grow concurrently, the individual is sterile.

(5) Both sets of organs grow equally to a definite period in embryonic life.

(6) Reproduction in Vertebrata, so far as is known, is impossible unless hypertrophy of one set of organs occur.

In conclusion let me point out, that my object in writing this paper is to endeavour to substantiate the doctrine that pathological processes do not exist *per se*, but that in all cases they are to be regarded as physiological processes in excess. I trust the view has been clearly expressed so far as concerns the very important process, hypertrophy.

Lastly, let me emphasize my meaning, that in many cases where organs or sets of organs have undergone hypertrophy to such a degree that pathologists would regard them as abnormal, these exceptional conditions have been inherited, and in this sense *pathology* may be assumed to have played a part among the ordinary processes of evolution in producing race peculiarities.

3. On the Remains of a Gigantic Species of Bird from Lower-Eocene Beds near Croydon. By E. T. NEWTON.

[Abstract.¹]

This paper describes certain bones of a large size obtained by Mr. H. M. Klaassen from the Lower-Eocene strata near Croydon, which are referable to a bird as large and heavy in build as the extinct *Dinornis crassus* of New Zealand.

After a detailed account of each of the specimens, which include parts of three or four tibio-tarsi, and a femur, they are compared

¹ This paper will be published entire in the Society's 'Transactions.'